

# ELECTRICAL & COMPUTER ENGINEERING AND MECHANICAL & MATERIALS ENGINEERING

---

## Electrical and Computer Engineering

Office: Ritchie School of Engineering and Computer Science  
 Mail Code: 2155 E. Wesley Ave, Room 283. Denver, CO 80208  
 Phone: 303.871.6618  
 Email: [eceinfo@du.edu](mailto:eceinfo@du.edu)  
 Web Site: <http://ritchieschool.du.edu/departments/ECE>

## Mechanical and Materials Engineering

Office: Ritchie School of Engineering and Computer Science  
 Mail Code: 2155 E. Wesley Ave, Room 277. Denver, CO 80208  
 Phone: 303.871.3041  
 Email: [mmeinfo@du.edu](mailto:mmeinfo@du.edu)  
 Web Site: <http://ritchieschool.du.edu/departments/MME>

The mission of the Departments of Electrical and Computer Engineering (ECE) and Mechanical and Materials Engineering (MME) at the undergraduate level is to offer programs that support and complement the University mission; to provide a general undergraduate education in computer, electrical, and mechanical engineering that prepares students for employment or graduate study; to include interdisciplinary engineering work in all programs; to encourage the professional status of the faculty; and to foster the professional awareness of the students. This statement concisely sums up the goals and objectives of our programs. All Engineering degrees are accredited by the Engineering Accreditation Commission of ABET.<sup>1</sup>

<sup>1</sup> 111 Market Place, Suite 1050  
 Baltimore, MD 21202-4012  
 Telephone: 410-347-7700

You will find information about the following topics below:

- Program Educational Objective
- Program Components
- Engineering Design
- Course of Study
- PINs and Undergraduate Research Assistantships
- Study Abroad
- Fundamentals of Engineering (FE) Exam & Enrollment as an Engineer-Intern (EI)

## Program Educational Objectives

The undergraduate program objectives of the Electrical and Computer and Mechanical and Materials Engineering Departments are to produce graduates who, within a few years of graduation:

1. Apply their engineering and problem solving skills towards engineering practice, engineering graduate school, or non-engineering fields such as medicine, science, business, law, or public policy, while continuing to engage in life-long learning.
2. Value and demonstrate character in their chosen vocation by acting responsibly, ethically, and professionally while contributing to a sustainable common good for society.
3. View their educational experience as valuable and instrumental to their professional success.

## Program Components

All of our engineering programs have several components:

1. The University of Denver's Common Curriculum, which includes First-year Seminar, Writing and Rhetoric, Ways of Knowing, and Advanced Seminar;
2. Basic sciences and mathematics, including chemistry, physics, and mathematics;
3. A common engineering background, with contributions from basic material in computer, electrical, and mechanical engineering;
4. A four-year integrated engineering sequence, stressing engineering design and project work, much of which is interdisciplinary and involves constructive teamwork;

5. An engineering discipline (computer engineering, electrical engineering, mechanical engineering);
6. A specialization giving the discipline more depth, or complementing it, according to the student's individual interests.

## Engineering Design

The feature of engineering programs that most differentiates them from programs in basic or applied science and mathematics is engineering design, which is both an art and a science. Our programs feature a four-year stem of course work required of all students, regardless of curriculum, which emphasizes design, project work, team-work, and the application of scientific and technical knowledge and design skills already acquired to the solution of interdisciplinary engineering problems. As the student progresses in the curriculum, more and more reliance is placed on previous work, and more realistic constraints and considerations are required for success. The sequence culminates in a three-quarter capstone design project carried out in the final year. Additional design work is contained in specialized courses.

## Course of Study

Engineering curricula are highly structured; acquisition of certain knowledge and skills must precede acquisition of more advanced ones. There is, thus, very little flexibility in the order in which courses must be completed, and there are few electives. Most engineering courses are offered only once a year, so an omission or deletion can add a year to the time required to complete the degree program. Although a high percentage of our students graduate in four years, it should be noted that, nationwide, nearly half of all engineering graduates take more than four years to complete their degrees, so students should not become discouraged if this is needed. The additional year may also be used to acquire additional expertise.

**Engineering Common Curriculum:** The curricula in all programs are the same for the first 5 quarters; a student can delay choosing an engineering major until the beginning of the spring quarter of their second year.

### Advanced Curriculum (Four Year Program):

The curricula for the last two years have several components:

1. Advanced work in the engineering discipline chosen;
2. Integrated engineering project work and design;
3. Development of a specialized area (details of the areas of specialization for each degree program are given later in this booklet);
4. Completion of the University of Denver Common Curriculum

### Advanced Curriculum (Five-Year Dual-Degree (BS/MS) Program):

The curricula for the last three years have several components:

1. Advanced work in the engineering discipline chosen;
2. Integrated engineering project work and design;
3. Completion of the University of Denver Common Curriculum;
4. Completion of the requirements for the MS in the engineering discipline.

For more information on any of these programs, please contact an advisor from either Electrical and Computer Engineering or Mechanical and Materials Engineering. Students interested in these options should discuss them with an advisor as early as possible in their undergraduate careers. For further information regarding these programs, visit the ECE (<http://ritchieschool.du.edu/departments/ECE>) and MME (<http://ritchieschool.du.edu/departments/MME>) web sites.

## PINS and Undergraduate Research Assistantships

Students wishing to participate in faculty research projects may be eligible for participation in PINS (Partners in Scholarship) or Undergraduate Research Assistantships (URA's). PINS is a University-wide program in which a student performs research in conjunction with a faculty member.

More information on PINS is available at <http://www.du.edu/urc/>. URA's work directly with faculty, often for compensation, on current research efforts. Students can read about faculty research interests on the ECE (<http://ritchieschool.du.edu/departments/ECE>) and MME (<http://ritchieschool.du.edu/departments/MME>) web sites. Such work enhances the student's ability to compete for scholarships, internships, entrance to graduate study and permanent employment. A limited number of these are available and are typically restricted to upper-division students with good academic backgrounds. An agreement with a specific faculty member is required and the URA is requested by, and granted to, the faculty member.

## Study Abroad

The University of Denver strongly encourages students to participate in study abroad programs, particularly the Cherrington Global Scholars Program; more information about which can be found at: <http://www.du.edu/intl/abroad/>

The engineering curricula have been structured so that students may take advantage of this opportunity in the autumn quarter of the senior year, rather than in the autumn quarter of the junior year, as is more usual in other DU programs.

Engineering students must be especially careful in planning this experience because of the highly restrictive and sequential nature of engineering curricula. It should also be noted that the abroad sites at which the required courses can be found are limited, vary depending on degree, and may change from one year to the next. Drs. Matt Gordon and Ron DeLyser are the department contacts for students interested in the Cherrington Global Scholar Program.

## Cooperative Education Program

Recognizing the value of experiential learning, we have created a paid co-op program which is optional and competitive for all Ritchie School students, though ideally suited for current sophomores and juniors. Through this collaborative program between academia and industry, students work full time at participating companies earning valuable work experience. Typically, students will not take classes for one full academic year, resuming their studies upon their return exactly in sequence but one year removed. In some cases, DU courses can be taken while on co-op. Dr. Matt Gordon is the department contact for students interested in the co-op program.

## Fundamentals of Engineering (FE) Examination and Enrollment as an Engineer-Intern (EI)

As an essential part of our assessment program, all mechanical engineering students in our ABET/EAC accredited curricula must register for and take the FE exam before graduation. This is optional for all electrical and computer engineering students, but highly recommended. The FE Exam is the first of a two-step process in order to become registered as a Professional Engineer (PE).

The FE exam is a national 6-hour examination administered by NCEES (National Council of Examiners for Engineering and Surveying) in conjunction with the Colorado State Board for Professional Engineers and Land Surveyors. Students must have completed at least 135 credits to apply to take the FE exam, for which a fee is charged. For more information please contact the MME department chair.

After passing the FE exam, the student must send a final transcript recording the receipt of an engineering degree to the Colorado State Board for Professional Engineers and Land Surveyors. Typically, after passing the FE exam, the requirements for registration as a PE are 4 years of engineering experience under the supervision of a PE with increasing engineering responsibility and passing the PE examination.

## Criteria for Entering Any of the Engineering Programs

In the first year, students should plan to take the following:

MATH 1951	Calculus I	4
MATH 1952	Calculus II	4
MATH 1953	Calculus III	4
PHYS 1211	University Physics I	5
PHYS 1212	University Physics II	5

Students lacking the mathematics preparation to begin calculus in the first quarter may take MATH 1070 College Algebra and Trigonometry followed by the usual calculus sequence; these students should meet with an advisor from the engineering department before enrolling for courses. Failure to complete the courses listed above in the first year may lead to an additional year of study.

## Minors in Engineering for Non-Engineering Students

Students desiring to minor in any of the engineering disciplines must take 20 hours of discipline specific engineering courses in addition to the equivalent of MATH 1951 Calculus I, MATH 1952 Calculus II, and MATH 1953 Calculus III. It is recommended that they have PHYS 1211 University Physics I, PHYS 1212 University Physics II, and PHYS 1213 University Physics III in their curriculum. Degree programs that “naturally flow” into an engineering minor are: chemistry, computer science, biology, mathematics and physics.

## Computer Engineering

### Bachelor of Science in Computer Engineering Requirements

(198 credits required for the degree (<http://bulletin.du.edu/undergraduate/undergraduateprograms/traditionalbachelorsprogram/bachelorofscienceincomputerengineering>))

This degree requires a minimum of 198 credits. Students not in the BSCPE/MBA combined program select a specialty area from communications, digital signal processing and networking; robotics, embedded systems and instrumentation, and computer systems engineering; or, under special circumstances, an individualized specialization may also be approved. Faculty mainly associated with computer engineering pursue research in

microprocessors, microsystems, biomedical systems, computer architecture, complex VLSI systems design, digital systems modeling and simulation, networks, parallel and distributed control, and processing.

## Requirements

198 credits are required for the degree including 48 credits of mathematics and basic science, 75 - 83 credits of engineering topics, and additional credit in computer science.

Code	Title	Credits
ENCE 2101	Digital Design	3
ENCE 3100	Advanced Digital System Design	4
ENCE 3210	Microprocessor Systems I	4
ENCE 3250	HDL Modeling & Synthesis	3
ENCE 3231	Embedded Systems Programming	4
ENCE 3241	Computer Organization and Architecture	3
ENCE 3501	VLSI Design	3
ENEE 2012	Circuits I and Laboratory	4
ENEE 2022	Circuits II	4
ENEE 2211	Electronics	4
ENEE 3111	Signals & Systems	4
ENGR 1511	Engineering Connections	1
ENGR 1572	Applied MATLAB Programming	3
ENGR 1611	Introduction to Mechanical Systems with CAD	4
ENGR 1622	Introduction to Mechatronic Systems I with MultiSim and MathCAD	4
ENGR 1632	Introduction to Mechatronic Systems II with LabView	4
ENGR 2610	Engineering Integration I	3
ENGR 2620	Engineering Integration II	3
ENGR 2950	Engineering Assessment I	0
ENGR 2951	Engineering Assessment II	0
ENGR 3100	Instrumentation and Data Acquisition	4
ENGR 3313	Engineering Design Project I	2
ENGR 3323	Engineering Design Project II	3
ENGR 3333	Engineering Design Project III	3
ENGR 3650	Probability and Statistics for Engineers	4
ENME 2510	Statics with Lab	4
ENME 2541	Mechanics of Materials	3
BUS XXXX Business Elective		4
Technical Electives		12

## Notes

Technical electives are used to complete specializations for the degree. Only technical courses may be used, and these must carry upper-division credit. Prior approval by the advisor is required.

## Additional Requirements

### Chemistry

Code	Title	Credits
CHEM 1010	General Chemistry I	3
CHEM 1240	General Chemistry I Laboratory	1

### Computer Science

Code	Title	Credits
COMP 1571	Procedural Programming I	3
COMP 1672	Introduction to Computer Science II	4
COMP 2300	Discrete Structures in Computer Science	1-4

COMP 2355	Intro to Systems Programming	4
COMP 2673	Introduction to Computer Science III	4

**Mathematics**

Code	Title	Credits
MATH 1951	Calculus I	4
MATH 1952	Calculus II	4
MATH 1953	Calculus III	4
MATH 2070	Introduction to Differential Equations	4
MATH 2080	Calculus of Several Variables	4

**Physics**

Code	Title	Credits
PHYS 1211	University Physics I	5
PHYS 1212	University Physics II	5
PHYS 1214	University Physics III for Engineers	4

Code	Title	Credits
<b>Legal Studies Requirement</b>		
LGST 2000-3999		4

**Notes**

Students must take an additional one (1) mathematics or science course from the approved list (4 credit hours). See Degree Program Plan for Approved courses.

Please see advisor for MATH/Sci/UCC requirements.

**Areas of Specialization**

All Bachelor of Science in Computer Engineering students are required to choose an area of specialization. The area of specialization can be fulfilled through the students choice of technical electives. The students must choose a minimum of 3 courses in one of the areas of specialization. For specific courses in the specialization areas, please see Degree Program Plan.

- **Communications, DSP, and Networking**
- **Computer Systems Engineering**
- **Robotics, Embedded Systems, and Instrumentation**
- **Individualized Option**

Nine credits of upper division technical courses selected with advisor's approval. A letter signed by the student's advisor giving the reason for the courses selected must be on file in the student's records.

**Minor Requirements for Computer Engineering**

20 credits, including:

Code	Title	Credits
COMP 1571	Procedural Programming I	3
ENCE 2101	Digital Design	3
ENEE 2012	Circuits I and Laboratory	4

<b>Electives</b>		10
ENCE courses at the 2000-level or above		

**Electrical Engineering****Bachelor of Science in Electrical Engineering Requirements**

(202 credits required for the degree (<http://bulletin.du.edu/undergraduate/undergraduateprograms/traditionalbachelorsprogram/bachelorofscienceinelectricalengineering>))

This program requires a minimum of 202 credits. Students not in the BSEE/MBA combined program select a specialization from communication systems and digital signal processing; robotics, electronics, photonics and microsystems; or power and energy; or, under special circumstances, an individualized specialization may also be approved. Faculty mainly associated with electrical engineering pursue research in the areas of communication systems and networks, digital signal processing, optical communication devices and systems, photonics, robotics and controls, and autonomous systems.

## Requirements

202 credits are required for the degree including 48 credits of mathematics and basic science and 75 - 83 credits of engineering topics.

Code	Title	Credits
ENCE 2101	Digital Design	3
ENCE 3210	Microprocessor Systems I	4
ENEE 2012	Circuits I and Laboratory	4
ENCE 3231	Embedded Systems Programming	4
ENEE 2022	Circuits II	4
ENEE 2211	Electronics	4
ENEE 2223	Advanced Electronics	4
ENEE 2611	Engineering Electromagnetics	4
ENEE 3011	Physical Electronics	4
ENEE 3111	Signals & Systems	4
ENEE 3130	Principles of Communication Systems	3
ENGR 1511	Engineering Connections	1
ENGR 1572	Applied MATLAB Programming	3
ENGR 1611	Introduction to Mechanical Systems with CAD	4
ENGR 1622	Introduction to Mechatronic Systems I with MultiSim and MathCAD	4
ENGR 1632	Introduction to Mechatronic Systems II with LabView	4
ENGR 2610	Engineering Integration I	3
ENGR 2620	Engineering Integration II	3
ENGR 2950	Engineering Assessment I	0
ENGR 2951	Engineering Assessment II	0
ENGR 3100	Instrumentation and Data Acquisition	4
ENGR 3313	Engineering Design Project I	2
ENGR 3323	Engineering Design Project II	3
ENGR 3333	Engineering Design Project III	3
ENGR 3510	Renewable and Efficient Power and Energy Systems	4
ENGR 3530	Introduction to Power and Energy Conversion Systems	3
ENGR 3721	Controls	3
ENGR 3611	Engineering Mathematics	3
ENGR 3650	Probability and Statistics for Engineers	4
ENGR 3722	Control Systems Laboratory	1
ENGR 3735	Linear Systems	4
ENME 2510	Statics with Lab	4
ENME 2520	Dynamics I with Lab	4
ENME 2541	Mechanics of Materials	3
BUS XXXX Business Elective		4
Technical Electives		11

## Notes

Technical electives are used to complete specializations for the degree. Only technical courses may be used, and these must carry upper-division credit. Prior approval by the advisor is required.

## Additional Requirements

### Chemistry

Code	Title	Credits
CHEM 1010	General Chemistry I	3
CHEM 1240	General Chemistry I Laboratory	1

**Computer Science**

Code	Title	Credits
COMP 1571	Procedural Programming I	3

**Mathematics**

Code	Title	Credits
MATH 1951	Calculus I	4
MATH 1952	Calculus II	4
MATH 1953	Calculus III	4
MATH 2070	Introduction to Differential Equations	4
MATH 2080	Calculus of Several Variables	4

**Physics**

Code	Title	Credits
PHYS 1211	University Physics I	5
PHYS 1212	University Physics II	5
PHYS 1214	University Physics III for Engineers	4

Code	Title	Credits
<b>Legal Studies Requirement</b>		
LGST 2000-3999		4

**Notes**

Students must take an additional one (1) mathematics or science course from the approved list (4 credit hours). See Degree Program Plan for Approved courses.

Please see advisor for Math/Sci/UCC requirements.

**Areas of Specialization**

All Bachelor of Science in Electrical Engineering students are required to choose an area of specialization. The area of specialization can be fulfilled through the students choice of technical electives. For specific courses in the specialization areas, please see Degree Program Plan.

- **Communications Systems and Digital Signal Processing**
- **Robotics**
- **Electronics, Photonics, and Microsystems**
- **Power and Energy**
- **Individualized Option**

Nine credits of upper-division technical courses selected with advisor's approval. A letter signed by the student's advisor giving the reason for the courses selected must be on file in the student's records.

**Electrical Engineering with a Concentration in Mechatronic Systems Engineering**

This degree program requires a minimum of 200 credits. Students not in the BSEE with a concentration in mechatronic systems engineering/MBA combined program select a specialization from mechanical systems, computer control and systems; or, under special circumstances, an individualized specialization may also be approved. Faculty associated with mechatronic systems engineering pursue research in the areas of robotics and controls and unmanned aerial systems.

## Requirements for the Concentration

(200 credits required for the degree (<http://bulletin.du.edu/undergraduate/undergraduateprograms/traditionalbachelorsprogram/bachelorofscienceinelectricalengineering>))

200 credits are required for the degree including 48 credits of mathematics and basic science and 75 - 83 credits of engineering topics.

Code	Title	Credits
ENCE 2101	Digital Design	3
ENCE 3210	Microprocessor Systems I	4
ENEE 2012	Circuits I and Laboratory	4
ENCE 3231	Embedded Systems Programming	4
ENEE 2022	Circuits II	4
ENEE 2211	Electronics	4
ENEE 2223	Advanced Electronics	4
ENEE 2611	Engineering Electromagnetics	4
ENEE 3111	Signals & Systems	4
ENGR 1511	Engineering Connections	1
ENGR 1572	Applied MATLAB Programming	3
ENGR 1611	Introduction to Mechanical Systems with CAD	4
ENGR 1622	Introduction to Mechatronic Systems I with MultiSim and MathCAD	4
ENGR 1632	Introduction to Mechatronic Systems II with LabView	4
ENGR 2610	Engineering Integration I	3
ENGR 2620	Engineering Integration II	3
ENGR 2950	Engineering Assessment I	0
ENGR 2951	Engineering Assessment II	0
ENGR 3100	Instrumentation and Data Acquisition	4
ENGR 3313	Engineering Design Project I	2
ENGR 3323	Engineering Design Project II	3
ENGR 3333	Engineering Design Project III	3
ENGR 3530	Introduction to Power and Energy Conversion Systems	3
ENGR 3611	Engineering Mathematics	3
ENGR 3650	Probability and Statistics for Engineers	4
ENGR 3721	Controls	3
ENGR 3722	Control Systems Laboratory	1
ENGR 3730	Robotics	3
ENGR 3731	Robotics Lab	1
ENGR 3735	Linear Systems	4
ENME 2510	Statics with Lab	4
ENME 2520	Dynamics I with Lab	4
ENME 2541	Mechanics of Materials	3
ENMT 3220	Mechatronics II - Real-Time Systems	4
BUS XXXX Business Elective		4
Technical Electives		10

### Notes

Technical electives are used to complete specializations for the degree. Only technical courses may be used, and these must carry upper-division credit. Prior approval by the advisor is required.

### Additional Requirements

#### Chemistry

Code	Title	Credits
CHEM 1010	General Chemistry I	3
CHEM 1240	General Chemistry I Laboratory	1

**Computer Science**

Code	Title	Credits
COMP 1571	Procedural Programming I	3

**Mathematics**

Code	Title	Credits
MATH 1951	Calculus I	4
MATH 1952	Calculus II	4
MATH 1953	Calculus III	4
MATH 2070	Introduction to Differential Equations	4
MATH 2080	Calculus of Several Variables	4

**Physics**

Code	Title	Credits
PHYS 1211	University Physics I	5
PHYS 1212	University Physics II	5
PHYS 1214	University Physics III for Engineers	4

Code	Title	Credits
Legal Studies Requirement		
LGST 2000-3999		4

**Notes**

Students must take an additional one (1) mathematics or science course from the approved list (4 credit hours). See Degree Program Plan for Approved courses.

**BSEE-MSE Specialization**

All EE-MSE students are required to choose an area of specialization. The area of specialization can be fulfilled through the students choice of technical electives. For specific courses in the specialization areas, please see Degree Program Plan.

- **Mechanical Systems**
- **Computer Systems**
- **Individualized Option**

Nine quarter hours of upper division technical courses selected with advisor's approval. A letter signed by the student's advisor giving the reason for the courses selected must be on file in the student's records.

**Minor Requirements for Electrical Engineering**

20 credits including:

Code	Title	Credits
ENEE 2012	Circuits I and Laboratory	4
ENEE 2022	Circuits II	4
ENEE 2211	Electronics	4
ENEE 3111	Signals & Systems	4

**Electives**

ENEE courses at the 2000-level or above		4
Total Credits		20

**Mechanical Engineering****Bachelor of Science in Mechanical Engineering (BSME)**

(192 credits required for the degree (<http://bulletin.du.edu/undergraduate/undergraduateprograms/traditionalbachelorsprogram/bachelorofscienceinmechanicalengineering/>))

Faculty mainly associated with mechanical engineering pursue research in the areas of composite materials, fatigue, atmospheric science, bioengineering, mechanisms and nondestructive evaluation.

## Requirements

192 credits are required for the degree including, at least 32 credits of non-engineering, at least 48 credits of mathematics and basic science, at least 103 credits of engineering topics and at least 3 open credit hours.

Code	Title	Credits
ENCE 2101	Digital Design	3
ENEE 2012	Circuits I and Laboratory	4
ENGR 1511	Engineering Connections	1
ENGR 1572	Applied MATLAB Programming	3
ENGR 1611	Introduction to Mechanical Systems with CAD	4
ENGR 1622	Introduction to Mechatronic Systems I with MultiSim and MathCAD	4
ENGR 1632	Introduction to Mechatronic Systems II with LabView	4
ENGR 2610	Engineering Integration I	3
ENGR 2620	Engineering Integration II	3
ENGR 2910	Engineering Economics and Ethics	3
ENGR 2950	Engineering Assessment I	0
ENGR 2951	Engineering Assessment II	0
ENGR 3313	Engineering Design Project I	2
ENGR 3323	Engineering Design Project II	3
ENGR 3333	Engineering Design Project III	3
ENME 2410	Materials Science I	3
ENME 2421	Materials Science II	3
ENME 2510	Statics with Lab	4
ENME 2520	Dynamics I with Lab	4
ENME 2530	Dynamics II	3
ENME 2540	System Dynamics	3
ENME 2541	Mechanics of Materials	3
ENME 2651	Fluid Dynamics I	3
ENME 2661	Fluid Dynamics II/Heat Transfer I	3
ENME 2671	Heat Transfer II with Lab	4
ENME 2710	Engineering Thermodynamics I	3
ENME 2720	Engineering Thermodynamics II	3
ENME 2810	Mechanical Engineering Lab I	3
ENME 3511	Machine Design	3
ENME 3810	Mechanical Engineering Capstone Laboratory	3
Technical Electives		12-16

## Additional Requirements

### Chemistry

Code	Title	Credits
CHEM 1010	General Chemistry I	3
CHEM 1240	General Chemistry I Laboratory	1

### Computer Science

Code	Title	Credits
COMP 1571	Procedural Programming I	3

### Mathematics

Code	Title	Credits
MATH 1951	Calculus I	4
MATH 1952	Calculus II	4
MATH 1953	Calculus III	4
MATH 2070	Introduction to Differential Equations	4
MATH 2080	Calculus of Several Variables	4

### Physics

Code	Title	Credits
PHYS 1211	University Physics I	5
PHYS 1212	University Physics II	5
PHYS 1214	University Physics III for Engineers	4

### Notes

Students must take an additional 2-4 mathematics or science courses from the approved list (10-14 credit hours). See Degree Program Plan for Approved courses.

## Minor Requirements for mechanical engineering

20 credits, including:

Code	Title	Credits
Select three of the following four courses:		9
ENME 2510	Statics with Lab	
ENME 2410	Materials Science I	
ENME 2651	Fluid Dynamics I	
ENME 2710	Engineering Thermodynamics I	

**Electives** 11

ENME courses at the 2000-level or above

## Computer Engineering

### Bachelor of Science in Computer Engineering Requirements

#### First Year

Fall	Credits Winter	Credits Spring	Credits
FSEM 1111	4 ENGR 1622	4 ENGR 1632	4
CHEM 1010	3 MATH 1952	4 MATH 1953	4
CHEM 1240	1 PHYS 1211	5 PHYS 1212	5
ENGR 1511	1 WRIT 1122	4 WRIT 1133	4
ENGR 1611	4		
MATH 1951	4		
	17	17	17

#### Second Year

Fall	Credits Winter	Credits Spring	Credits
COMP 1571	3 ENEE 2012	4 ENEE 2022	4
ENCE 2101	3 ENGR 1572	3 ENGR 2950	0
ENME 2510	4 ENME 2541	3 ENGR 3100	4
PHYS 1214	4 MATH 2070	4 MATH 2080	4
Math/Sci/UCC	4 Math/Sci/UCC	4 Math/Sci/ UCC	4
	18	18	16

#### Third Year

Fall	Credits Winter	Credits Spring	Credits
ENCE 3100	4 COMP 1672	4 COMP 2300	4
ENEE 2211	4 ENCE 3210	4 ENCE 3231	4
ENEE 3111	4 ENCE 3241	3 ENCE 3250	3
Math/Sci/UCC	4 ENGR 2610	3 ENGR 2620	3

	ENGR 3650	4 COMP 2673	4
	16	18	18
<b>Fourth Year</b>			
<b>Fall</b>	<b>Credits Winter</b>	<b>Credits Spring</b>	<b>Credits</b>
ENCE 3501	3 ENGR 3323	3 ASEM 2XXX Advanced Seminar	4
ENGR 3313	2 COMP 2355	4 BUS XXXX Business Elective	4
Math/Sci/UCC	4 LGST XXXX Legal Studies Elective	4 ENGR 3333	3
Technical Elective	4 Technical Elective	4 Technical Elective	4
		ENGR 2951	0
	13	15	15

Total Credits: 198

## Notes

**UCC – University Common Curricula-** These may be taken in any order. They must have 2 courses with attributes of analytical inquiry: society and 2 courses attributes of scientific inquiry: society.

**ASEM 2XXX - Advanced Seminar Engineering** students are required to take a writing-intensive advanced seminar. Junior standing is also required.

**Technical Elective.** Technical electives are used to complete specializations for the degree. Only technical courses may be used, and these must carry upper-division credit. Prior approval by the advisor is required.

**Math/Sci.** One (1) math or science course from the approved list (11 credits). Note that without prior advisor approval only one approved math or science course may be taken instead of a UCC course in the first two years.

Total credits may vary based on technical elective options

### Approved Math/Sci Courses (subject to participating department course offerings):

#### Biology

BIOL 1010 Physiological Systems w/ BIOL 1020 Physiological Systems Lab; BIOL 1011 Evolution, Heredity and Biodiversity w/ BIOL 1021 Evolution, Heredity and Biodiversity Lab;; BIOL 2090 Biostatistics; BIOL 2120 Cell Structure and Function w/ BIOL 2121 Cell Structure & Function Lab; BIOL 3250 Human Physiology

#### Chemistry

CHEM 1020 General Chemistry II w/ CHEM 1250 General Chemistry II Laboratory; CHEM 2131 Chemistry of the Elements w/ CHEM 2141 Chemistry of the Elements Lab; CHEM 2240 Introduction to Environmental Chemistry; CHEM 2270 Quantitative Chemical Analysis

#### Math

MATH 2060 Elements of Linear Algebra; MATH 3080 Introduction to Probability; MATH 3090 Mathematical Probability; MATH 3851 Functions Complex Variable

#### Physics

PHYS 2251 Modern Physics I; PHYS 2252 Modern Physics II w/ PHYS 2260 Modern Physics Lab; PHYS 2259 Uncertainty and Error Analysis; PHYS 2300 Physics of the Body; PHYS 2340 Medical Imaging Physics; PHYS 3510 Analytical Mechanics I; PHYS 3711 Optics I

## Areas of Specialization

All Bachelor of Science in Computer Engineering students are required to choose an area of specialization. The area of specialization can be fulfilled through the students choice of technical electives. The students must choose a minimum of 3 courses in one of the areas of specialization.

### Communications, DSP, and Networking

Select three courses from the following: <sup>1</sup>

ENCE 3261	Fault Tolerant Computing	3
ENCE 3321	Network Design	4
ENCE 3630	Pattern Recognition	4
ENEE 3130	Principles of Communication Systems	3
ENEE 3141	Digital Communications	3
ENEE 3670	Introduction to Digital Signal Processing	4

## Computer Systems Engineering

Select three courses from the following:<sup>1</sup>

COMP 3501	Introduction to Artificial Intelligence	4
COMP 3801	Introduction Computer Graphics	4
ENCE 3261	Fault Tolerant Computing	3
ENCE 3321	Network Design	4
ENCE 3620	Computer Vision	4
ENMT 3220	Mechatronics II - Real-Time Systems	4
COMP 2370	Introduction to Algorithms & Data Structures	4

## Robotics, Embedded Systems, and Instrumentation

Select three courses from the following:<sup>1</sup>

COMP 3501	Introduction to Artificial Intelligence	4
COMP 3801	Introduction Computer Graphics	4
ENCE 3261	Fault Tolerant Computing	3
ENCE 3321	Network Design	4
ENCE 3620	Computer Vision	4
ENCE 3630	Pattern Recognition	4
ENGR 3721	Controls	3
ENGR 3730	Robotics	3
ENMT 3220	Mechatronics II - Real-Time Systems	4

## Individualized Option

Nine credits of upper division technical courses selected with advisor's approval. A letter signed by the student's advisor giving the reason for the courses selected must be on file in the student's records.

<sup>1</sup> Students may also take Special Topics or Independent Study as appropriate for this option

# Electrical Engineering

## Bachelor of Science in Electrical Engineering Requirements

### First Year

Fall	Credits Winter	Credits Spring	Credits
FSEM 1111	4 ENGR 1622	4 ENGR 1632	4
CHEM 1010	3 MATH 1952	4 MATH 1953	4
CHEM 1240	1 PHYS 1211	5 PHYS 1212	5
ENGR 1511	1 WRIT 1122	4 WRIT 1133	4
ENGR 1611	4		
MATH 1951	4		
	17	17	17

### Second Year

Fall	Credits Winter	Credits Spring	Credits
COMP 1571	3 ENEE 2012	4 ENEE 2022	4
ENCE 2101	3 ENGR 1572	3 ENGR 2950	0
ENME 2510	4 ENME 2541	3 ENGR 3100	4
Undergraduate Common Curriculum	4 MATH 2070	4 ENME 2520	4
PHYS 1214	4 Undergraduate Common Curriculum	4 MATH 2080	4
	18	18	16

### Third Year

Fall	Credits Winter	Credits Spring	Credits
ENEE 2211	4 ENCE 3210	4 ENEE 2223	4
ENEE 2611	4 ENEE 3130	3 ENGR 2620	3
ENEE 3111	4 ENGR 2610	3 ENEE 3011	4
ENGR 3530	3 ENGR 3721	3 ENCE 3231	4
ENGR 3611	3 ENGR 3722	1	

		ENGR 3650	4		
		18		18	15
<b>Fourth Year</b>					
<b>Fall</b>		<b>Credits Winter</b>		<b>Credits Spring</b>	<b>Credits</b>
ENGR 3510		4 ENGR 3323		3 ASEM 2XXX Advanced Seminar	4
ENGR 3735		4 LGST XXXX Legal Studies Elective		4 BUS XXXX Business Elective	4
ENGR 3313		2 Undergraduate Common Curriculum		4 ENGR 3333	3
Undergraduate Common Curriculum		4 Technical Elective		4 ENGR 2951	0
Technical Elective		4		Technical Elective	4
		18		15	15

Total Credits: 202

## Notes

**University Common Curriculum** - These may be taken in any order. They must have 2 courses with attributes of analytical inquiry: society and 2 courses attributes of scientific inquiry: society.

**ASEM 2XXX - Advanced Seminar Engineering** students are required to take a writing-intensive advanced seminar. Junior standing is also required.

**Technical Elective.** Technical electives are used to complete specializations for the degree. Only technical courses may be used, and these must carry upper-division credit. Prior approval by the advisor is required.

## Areas of Specialization

All Bachelor of Science in Electrical Engineering students are required to choose an area of specialization. The area of specialization can be fulfilled through the students choice of technical electives.

### Communications Systems and Digital Signal Processing

Required:

ENEE 3141	Digital Communications	3
-----------	------------------------	---

And two of the following: <sup>1</sup>

ENEE 3321	Network Design	4
ENEE 3620	Optical Fiber Communications	4
ENEE 3670	Introduction to Digital Signal Processing	4

### Robotics

Select three courses from the following: <sup>1</sup>

ENEE 3100	Advanced Digital System Design	4
ENEE 3620	Computer Vision	4
ENGR 3100	Instrumentation and Data Acquisition	4
ENGR 3730	Robotics	3
ENME 3545	Mechanisms	4
ENMT 3220	Mechatronics II - Real-Time Systems	4

### Electronics, Photonics, and Microsystems

Select three courses from the following: <sup>1</sup>

ENEE 3030	Optoelectronics	4
ENEE 3035	Photonics	4
ENEE 3620	Optical Fiber Communications	4
ENGR 3210	Intro Nano-Electro-Mechanics	4
ENGR 3520	Introduction to Power Electronics	4
ENGR 3525	Power Electronics and Renewable Energy Laboratory	1

### Power and Energy

One of the following: <sup>1</sup>

ENGR 3525	Power Electronics and Renewable Energy Laboratory	1
ENGR 3535	Electric Power Engineering Laboratory	1

And two of the following:

ENGR 3520	Introduction to Power Electronics	4
-----------	-----------------------------------	---

ENGR 3540	Electric Power Systems	4
ENGR 3545	Electric Power Economy	3

### Individualized Option

Nine credits of upper-division technical courses selected with advisor's approval. A letter signed by the student's advisor giving the reason for the courses selected must be on file in the student's records.

<sup>1</sup> Students may also take Special Topics or Independent Study as appropriate for this option

## Electrical Engineering with a Concentration in Mechatronic Systems Engineering

### Bachelor of Science in Electrical Engineering with a concentration in mechatronic systems engineering Requirements

First Year			
Fall	Credits Winter	Credits Spring	Credits
FSEM 1111	4 ENGR 1622	4 ENGR 1632	4
CHEM 1010	3 MATH 1952	4 MATH 1953	4
CHEM 1240	1 PHYS 1211	5 PHYS 1212	5
ENGR 1511	1 WRIT 1122	4 WRIT 1133	4
ENGR 1611	4		
MATH 1951	4		
	17	17	17
Second Year			
Fall	Credits Winter	Credits Spring	Credits
COMP 1571	3 ENEE 2012	4 ENEE 2022	4
ENCE 2101	3 ENGR 1572	3 ENGR 2950	0
ENME 2510	4 ENME 2541	3 ENGR 3100	4
Undergraduate Common Curriculum	4 MATH 2070	4 ENME 2520	4
PHYS 1214	4 Undergraduate Common Curriculum	4 MATH 2080	4
	18	18	16
Third Year			
Fall	Credits Winter	Credits Spring	Credits
ENEE 2211	4 ENCE 3210	4 ENCE 3231	4
ENEE 3111	4 ENGR 2610	3 ENEE 2223	4
ENGR 3530	3 ENGR 3721	3 ENGR 2620	3
ENME 2530	3 ENGR 3722	1 ENMT 3220	4
ENGR 3611	3 ENGR 3650	4	
	17	15	15
Fourth Year			
Fall	Credits Winter	Credits Spring	Credits
ENEE 2611	4 ENGR 3323	3 ASEM 2XXX Advanced Seminar	4
ENGR 3313	2 ENGR 3730	3 BUS XXXX Business Elective	
ENGR 3735	4 ENGR 3731	1 ENGR 3333	3
Undergraduate Common Curriculum	4 LGST XXXX Legal Studies Elective	4 ENGR 2951	0
Technical Elective	4 Undergraduate Common Curriculum	4 Technical Elective	3
	Technical Elective	3	
	18	18	10

Total Credits: 196

### Notes

**University Common Curriculum** - These may be taken in any order. They must have 2 courses with attributes of analytical inquiry: society and 2 courses attributes of scientific inquiry: society.

**ASEM 2XXX - Advanced Seminar Engineering** students are required to take a writing-intensive advanced seminar. Junior standing is also required.

**Technical Elective.** Technical electives are used to complete specializations for the degree. Only technical courses may be used, and these must carry upper-division credit. Prior approval by the advisor is required.

## Areas of Specialization

### BSEE-MSE Specialization

All EE-MSE students are required to choose an area of specialization. The area of specialization can be fulfilled through the student's choice of technical electives.

#### Mechanical Systems

Students must choose from 3 of the following:<sup>1</sup>

ENME 2810	Mechanical Engineering Lab I	3
ENME 2820	Mechanical Engineering Lab II	3
ENME 3511	Machine Design	3
ENME 3545	Mechanisms	4

#### Computer Systems

Students must take the following:<sup>1</sup>

ENCE 3231	Embedded Systems Programming	4
ENCE 3261	Fault Tolerant Computing	3
ENCE 3241	Computer Organization and Architecture	3

#### Individualized Option

Nine quarter hours of upper division technical courses selected with advisor's approval. A letter signed by the student's advisor giving the reason for the courses selected must be on file in the student's records.

<sup>1</sup> Students may also take Special Topics or Independent Study as appropriate for this option

## Mechanical Engineering

#### First Year

Fall	Credits Winter	Credits Spring	Credits
FSEM 1111	4 ENGR 1622	4 ENGR 1632	4
CHEM 1010	3 MATH 1952	4 PHYS 1212	5
CHEM 1240	1 PHYS 1211	5 MATH 1953	4
ENGR 1511	1 WRIT 1122	4 WRIT 1133	4
ENGR 1611	4		
MATH 1951	4		
	17	17	17

#### Second Year

Fall	Credits Winter	Credits Spring	Credits
COMP 1571	3 ENEE 2012	4 ENGR 2950	0
ENCE 2101	3 ENGR 1572	3 ENME 2520	4
ENME 2510	4 ENME 2541	3 ENME 2710	3
Math/Sci/UCC*	4 MATH 2070	4 MATH 2080	4
PHYS 1214	4 Math/Sci/UCC*	4 Math/Sci/UCC*	4
	18	18	15

#### Third Year

Fall	Credits Winter	Credits Spring	Credits
ENME 2410	3 ENGR 2610	3 ENGR 2620	3
ENME 2530	3 ENME 2421	3 ENGR 2910	3
ENME 2651	3 ENME 2661	3 ENME 2671	4
ENME 2720	3 ENME 3511	3 ENME 2540	3
Math/Sci/Tech/Law/UCC*	4 Math/Sci/Tech/Law/UCC*	4 Math/Sci/Tech/Law/UCC*	4
	16	16	17

#### Fourth Year

Fall	Credits Winter	Credits Spring	Credits
ASEM 2XXX Advanced Seminar*	4 ENGR 3323	3 ENGR 3333	3
ENGR 3313	2 ENME 2810	3 ENME 3810 (Mechanical Engr Capstone Lab)	3
Math/Sci/Tech/Law/UCC*	4 Math/Sci/Tech/Law/UCC*	4 ENGR 2951	0
Math/Sci/Tech/Law/UCC*	4 Math/Sci/Tech/Law/UCC*	4 Math/Sci/Tech/UCC*	3-4

		0000 Open Elective*	4-3
	14	14	13

Total Credits: 192

**\*NOTES:**

**UCC – University Common Curricula.** These may be taken in any order. They must have 2 courses with attributes of analytical inquiry: society and 2 courses attributes of scientific inquiry: society (16 credits).

**ASEM 2XXX - Advanced Seminar.** Required writing-intensive advanced seminar. Junior or senior standing is required (4 credits)

**0000 - Open Elective.** May be any course at the 1000 level or above (3 or 4 credits as needed to reach 192 total QH).

**Math/Sci/Tech/Law.** Three (3) 3000 or higher engineering courses (ENGR, ENME, ENEE, ENCE, ENBI, ENMT, or MTSC), which are not required for the major (12 credits). 2-4 math or science courses from the approved list (10 credits). 1 math or science or technical or computer science or law school course (3 or 4 credits). Note that without prior advisor approval only one approved math or science course may be taken instead of a UCC course in the first two years.

**Approved Math/Sci/Law Courses (subject to participating department course offerings):**

**Biology**

BIOL 1010 Physiological Systems w/BIOL 1020 Physiological Systems Lab; BIOL 1011 Evolution, Heredity and Biodiversity w/BIOL 1021 Evolution, Heredity and Biodiversity Lab; BIOL 2450 Human Anatomy; BIOL 2090 Biostatistics; BIOL 2120 Cell Structure and Function w/BIOL 2121 Cell Structure & Function Lab; BIOL 3250 Human Physiology

**Chemistry**

CHEM 1020 General Chemistry II w/ CHEM 1250 General Chemistry II Laboratory; CHEM 2131 Chemistry of the Elements w/ CHEM 2141 Chemistry of the Elements Lab; CHEM 2240 Introduction to Environmental Chemistry; CHEM 2270 Quantitative Chemical Analysis

**Math**

MATH 2060 Elements of Linear Algebra; MATH 3080 Introduction to Probability; MATH 3090 Mathematical Probability; MATH 3851 Functions Complex Variable

**Physics**

PHYS 2251 Modern Physics I; PHYS 2252 Modern Physics II w/ PHYS 2260 Modern Physics Lab; PHYS 2259 Uncertainty and Error Analysis; PHYS 2300 Physics of the Body; PHYS 2340 Medical Imaging Physics; PHYS 3510 Analytical Mechanics I; PHYS 3711 Optics I

**Law School**

LAWS 4310 Introduction to Intellectual Property; LAWS 4220 Environmental Law

## Requirements for Distinction in the Major in Computer Engineering

- Minimum 3.3 cumulative GPA
- Undergrad research project including Research paper and presentation

## Requirements for Distinction in the Major in Electrical Engineering

- Minimum 3.3 cumulative GPA
- Undergrad research project including Research paper and presentation

## Requirements for Distinction in the Major in Mechanical Engineering

- Minimum 3.3 cumulative GPA
- Undergrad research project including Research paper and presentation